

# NGVAMERICA

Natural Gas Vehicles for America

## Make a Bold Impact on Air Quality Today

Natural gas vehicles can transform our nation's medium- and heavy-duty transportation sector & are the most cost-effective choice for VW settlement funds



# About NGVAmerica

NGVAmerica is the national organization dedicated to the development of a growing, profitable, and sustainable marketplace for vehicles powered by natural gas and for using more natural gas in transportation.



# 200+

NGVAmerica represents 200+ companies,  
LDCs, fleets, OEMS, environmental and  
government organizations.

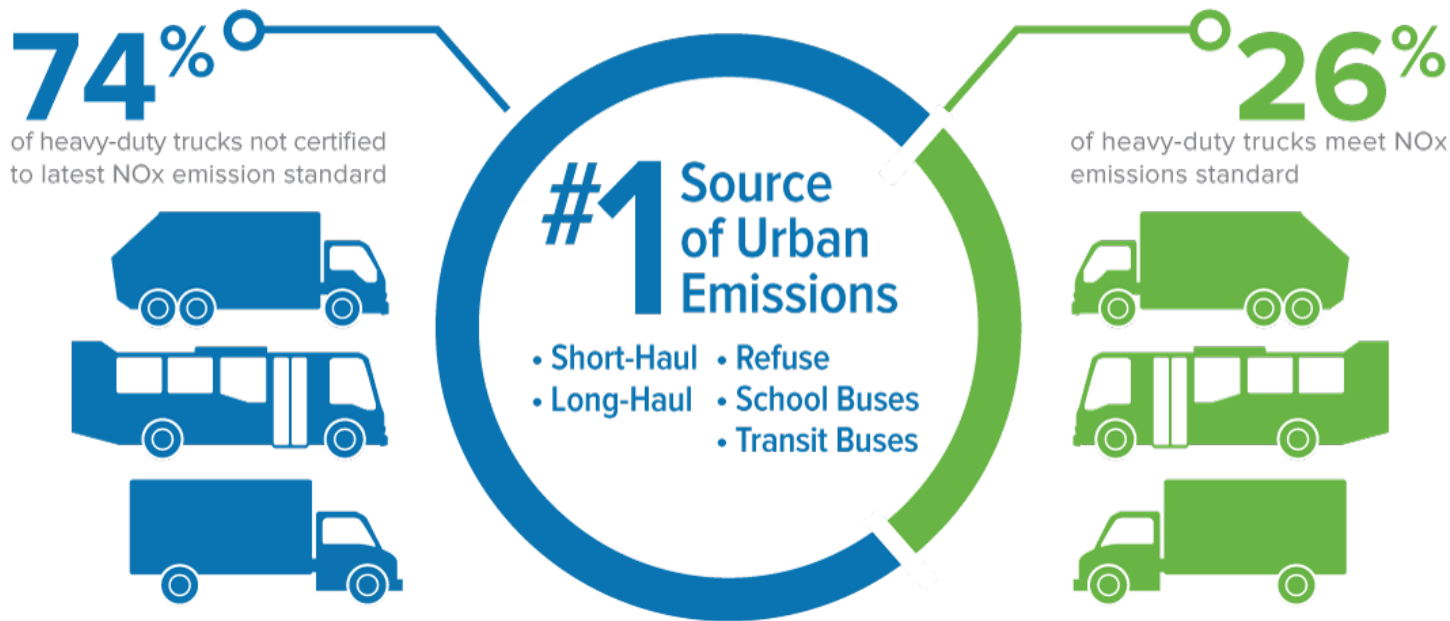


# The Problem

## Urban Emissions & Public Health

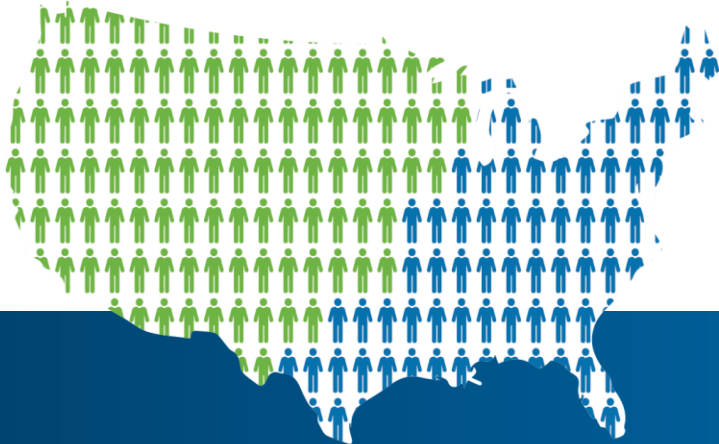


# Urban Emissions: Leading Sources



Source: DTF Analysis on HIS Vehicles in Operation Data, December 2015

# 166 Million



## ≈ 50%

of Americans live in areas with  
air that is unhealthy to breathe

*Source: American Lung Association's "State of the Air 2016"*

## Urban Emissions: Public Health Impacts

Breathing in particle pollution  
increases the risk of:

- Asthma
- Lung Cancer
- Heart Disease
- Premature Death

# The Opportunity

## Volkswagen Environmental Mitigation Trust Funding



# \$2.9 Billion Volkswagen Environmental Mitigation Trust

## Funding must be used to:

- Address excess nitrogen oxide (NOx) emissions through vehicle purchases/repowers
- Benefit residents in areas with greatest need (e.g., near urban/industrial areas)
- Replace polluting diesel equipment with cleaner, new or repowered vehicles, including:
  - Local freight trucks
  - Transit buses
  - School buses
  - Shuttle buses
  - Refuse trucks

# Funds for Each State (\$2,925,000,000)

Initial Subaccounts	Combined Totals
Alaska	\$8,125,000.00
Hawaii	\$8,125,000.00
North Dakota	\$8,125,000.00
Puerto Rico	\$8,125,000.00
South Dakota	\$8,125,000.00
Wyoming	\$8,125,000.00
District of Columbia	\$8,125,000.00
Delaware	\$9,676,682.97
Mississippi	\$9,874,413.91
West Virginia	\$12,131,842.13
Nebraska	\$12,248,347.48
Montana	\$12,602,424.88
Rhode Island	\$14,368,857.94
Arkansas	\$14,647,709.09
Kansas	\$15,662,238.80
Idaho	\$17,349,037.39
New Mexico	\$17,982,660.90
Vermont	\$18,692,130.18
Louisiana	\$19,848,805.30

Initial Subaccounts	Combined Totals
Kentucky	\$20,378,649.58
Oklahoma	\$20,922,485.12
Iowa	\$21,201,737.70
Maine	\$21,053,064.48
South Carolina	\$33,895,491.39
Nevada	\$24,874,024.48
Alabama	\$25,480,967.86
New Hampshire	\$30,914,841.09
Utah	\$35,177,506.14
Indiana	\$40,935,880.59
Missouri	\$41,152,051.74
Tennessee	\$45,759,914.40
Minnesota	\$47,001,661.43
Connecticut	\$55,721,169.94
Arizona	\$56,660,078.00
Georgia	\$63,624,725.56
Michigan	\$64,807,014.63
Colorado	\$68,739,918.33

Initial Subaccounts	Combined Totals
Wisconsin	\$67,077,457.70
New Jersey	\$72,215,085.39
Oregon	\$72,967,518.46
Massachusetts	\$75,064,424.40
Maryland	\$75,714,238.01
Ohio	\$75,302,522.67
North Carolina	\$92,045,658.00
Virginia	\$93,633,980.48
Illinois	\$108,679,676.98
Washington	\$112,745,650.15
Pennsylvania	\$118,569,539.52
New York	\$127,701,806.94
Florida	\$166,278,744.54
Texas	\$209,319,163.57
California	\$422,636,320.14
Tribal acct	\$54,447,921.22
Tribal Admin Cost	\$1,088,958.42
Trust Admin Cost	\$29,250,000.00



# The Solution

**Natural Gas Vehicles: Sustainable,  
Responsible, Available**



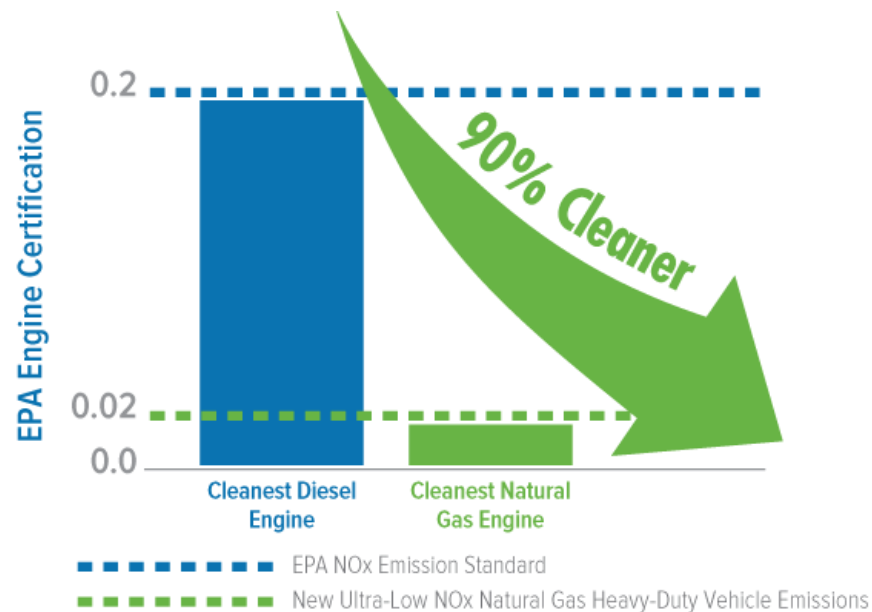


# Sustainable

NGVs Offer Unmatched Emission  
Reduction Benefits

# The cleanest heavy-duty truck engine in the world is powered by natural gas

- Certified in 2015 by the U.S. Environmental Protection Agency and California Air Resources Board



The Cummins Westport Ultra-Low NOx engine is certified to a 0.02 g/bhp-hr standard, which is:

- 90% cleaner than the EPA's current NOx standard
- 90% cleaner than the latest available diesel engine

# Cummins Westport Optional Near Zero Product Line



## **ISB6.7 G**

**6.7L**

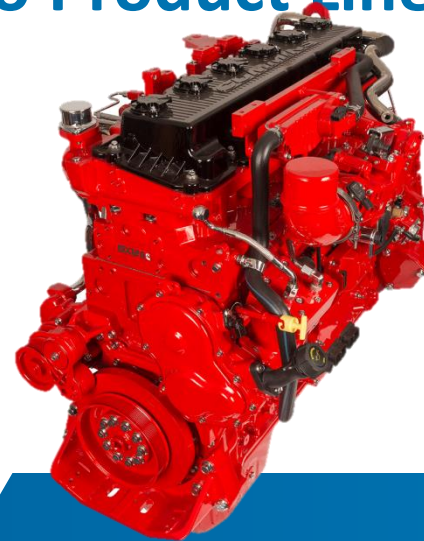
- Spark Ignited, SEGR, TWC
- Peak Rating: 240 hp
- 560 lb-ft torque
- 33,000 lb. GVW
- School bus/Shuttle  
bus/Sweeper/Yard spotter
- 0.1 g/bhp NOx Available Now



## **ISL G**

**8.9L**

- Spark Ignited, SEGR, TWC
- Peak Rating: 320 hp
- 1000 lb-ft torque
- 66,000 lb. GVW
- Refuse/Transit/Regional P&D  
Truck/Mixers
- NZ Available Now



## **ISX12 G**

**11.9L**

- Spark Ignited, SEGR, TWC
- Peak Rating: 400 hp
- 1450 lb-ft torque
- 80,000 lb. GVW
- Regional Haul Truck/Tractor/Refuse
- NZ Available Q1 2018

In-use testing results of heavy-duty trucks in port applications found:

## » Natural gas vehicles emitted lower NOx:

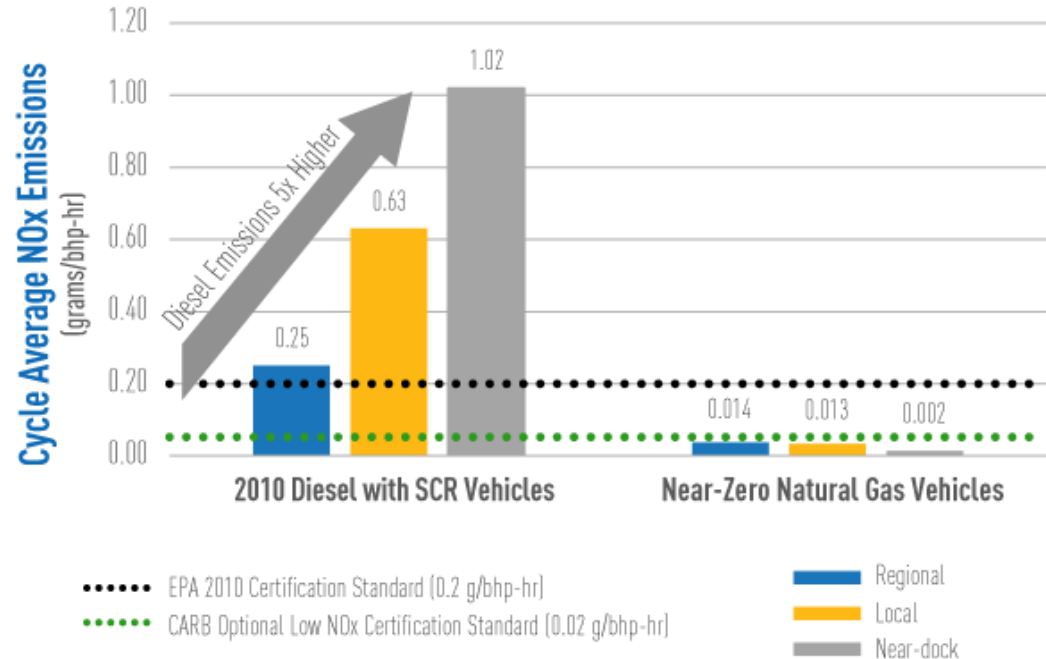
The ISL G natural gas engine emitted lower NOx emissions than its EPA certification standard. Emissions decreased as the duty cycles decreased (i.e., slower speeds, idling, stop-and-go traffic).

## » Diesel vehicles emit up to 5x more NOx:

2010 diesel engines with SCR emitted up to 5 times more NOx emissions than its EPA certification standard. Emissions increased as the duty cycles decreased.



## Comparing NOx Emissions in Port Truck Operations



Fueling with  
natural gas  
reduces CO<sub>2</sub> and  
greenhouse gas  
emissions



## Natural Gas Reduces WTW Greenhouse Gas Emissions

Compared to Diesel:



**11% reduction**



**17% reduction**



Renewable  
natural gas (RNG)  
provides even  
greater CO<sub>2</sub> and  
greenhouse gas  
emission  
reductions



Carbon Intensity Rating of Key Transportation Fuels

Transportation Fuel	EER-Adjusted Carbon Intensity
Diesel (conventional)	102.01
Natural gas (conventional)	88.60
Hydrogen (from natural gas)	55.61
Electricity (California grid)	38.95
RNG - Landfill gas	33.89 to 65.64
RNG - Wastewater biogas	8.61 to 34.36
RNG - Food/green waste biogas	-25.48
RNG - Dairy biogas (prospective)	-303.30



## WTW Greenhouse Gas Emissions Reductions

Compared to Diesel:



**40-125% reduction**

# What does this really mean?



NGVs + RNG offer the cleanest commercially available path to reduce heavy-duty vehicle emissions (for likely a decade or more).





# Responsible

NGVs Maximize the Impact of  
Available Funding

## Short/Regional Haul Truck Comparison – 100% Funding Scenario



### Natural Gas



Technology Cost \$150,000

**NOx Reduced 3,810 lbs**



### Diesel

Technology Cost \$100,000

NOx Reduced 1,858 lbs



### Electric

Technology Cost \$324,000

NOx Reduced 3,810 lbs

Data Source: NOx emissions are based on low-NOx natural gas engines. EV emissions are the same as natural gas emissions based on the inclusion of power plant emissions, EPA MOVES emission factors for 2017 diesel vehicle, and EPA MOVES for 2007 replacement diesel vehicles. Useful life, cost and mileage vary by applications. Additional details available from NGVA upon request.

**Dollar-for-Dollar, NGVs Deliver the Largest & Most Cost-Effective NOx Emissions Reductions**



## Refuse Comparison – 100% Funding Scenario

**\$140**

per lb of NOx



**Natural Gas**



Technology Cost \$300,000

**NOx Reduced 2,141 lbs**

**\$190**

per lb of NOx



**Diesel**

Technology Cost \$270,000

NOx Reduced 1,417 lbs

**\$313**

per lb of NOx



**Electric**

Technology Cost \$670,000

NOx Reduced 2,141 lbs

Data Source: NOx emissions are based on low-NOx natural gas engines. EV emissions are the same as natural gas emissions based on the inclusion of power plant emissions, EPA MOVES emission factors for 2017 diesel vehicle, and EPA MOVES for 2007 replacement diesel vehicles. Useful life, cost and mileage vary by applications. Additional details available from NGVA upon request.

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## School Bus Comparison – 100% Funding Scenario

**\$220**

per lb of NOx



**Natural Gas**



Technology Cost \$148,000

**NOx Reduced 671 lbs**

**\$291**

per lb of NOx



**Diesel**

Technology Cost \$115,000

NOx Reduced 396 lbs

**Not Commercially Available**



**Electric**

Data Source: NOx emissions are based on low-NOx natural gas engines. EV emissions are the same as natural gas emissions based on the inclusion of power plant emissions, EPA MOVES emission factors for 2017 diesel vehicle, and EPA MOVES for 2007 replacement diesel vehicles. Useful life, cost and mileage vary by applications. Additional details available from NGVA upon request.

**Dollar-for-Dollar, NGVs Deliver the Largest & Most Cost-Effective NOx Emissions Reductions**



## Transit Comparison – 100% Funding Scenario

**\$273**

per lb of NOx



### Natural Gas



Technology Cost \$360,000

**NOx Reduced 1,318 lbs**

**\$540**

per lb of NOx



### Diesel

Technology Cost \$300,000

NOx Reduced 555 lbs

**\$569**

per lb of NOx



### Electric

Technology Cost \$750,000

NOx Reduced 1,318 lbs

Data Source: NOx emissions are based on low-NOx natural gas engines. EV emissions are the same as natural gas emissions based on the inclusion of power plant emissions, EPA MOVES emission factors for 2017 diesel vehicle, and EPA MOVES for 2007 replacement diesel vehicles. Useful life, cost and mileage vary by applications. Additional details available from NGVA upon request.

**Dollar-for-Dollar, NGVs Deliver the Largest & Most Cost-Effective NOx Emissions Reductions**



**18–24 month  
payback**



**Lower Fuel  
Costs:**

Can be >\$1.00/gallon cheaper



**Lower  
maintenance  
costs**



Depending on range and application, fleets can realize a pay back in as little as 18–24 months due to:

- Lower fuel costs
- Lower maintenance costs





# Available

NGVs are Road-Tested &  
Commercially Available

Available from  
OEMs with  
established sales  
and service  
networks

#### HD Vocational OEMs

- Autocar Truck
- Capacity
- Crane Carrier
- Elgin
- Johnston
- Kalmar
- Mack
- McNeilus
- Peterbilt
- Power Solutions Int'l
- Schwarze
- Tymco

#### HD OEMs

- Cummins Westport
- Freightliner
- Kenworth
- Mack
- Peterbilt
- Volvo

#### HD Bus OEMs

- Blue Bird Bus
- DesignLine
- El Dorado
- Gillig
- New Flyer
- New Flyer/NABI Bus
- NOVA Bus
- Motor Coach Industries
- Thomas Built Bus

#### HD Retrofit/ Repowers

- American Power Group
- Clean Air Power
- Diesel 2 Gas
- Fyda Energy Solutions
- NGV Motori
- Omnitek Engineering

#### MD Retrofits

- AGA Systems
- Altech-Eco
- Crazy Diamond Performance
- Greenkraft
- Landi Renzo USA/Baytech
- M-Tech Solutions
- Nat-G
- NGV Motori USA
- PowerFuel Conversions
- Roush CleanTech
- STAG
- Westport Fuel Systems
- Zavoli

#### Fuel Systems

- Agility Fuel Solutions
- Momentum Fuel Technologies
- Mainstay





# Class 4-6 Vehicles and NGV Availability

## Class Four: 14,001 - 16,000 lbs.



City Delivery



Conventional Van



Landscape Utility



Large Walk In

## Class Five: 16,001 - 19,500 lbs.



Bucket



City Delivery



Large Walk In

## Class Six: 19,501 - 26,000 lbs.



Beverage



Rack



School Bus



Single Axle Van



Stake Body



# Class 4-6 Vehicles and NGV Availability



# Class 7-8 Vehicles and NGV Availability

## Class Seven: 26,001 - 33,000 lbs.



City Transit Bus



Furniture



High Profile Semi



Home Fuel

## Class Eight: 33,001 lbs. & over



Cement Mixer



Dump



Fire Truck



Fuel



Refrigerated Van



Semi Sleeper



Tour Bus



Heavy Semi Tractor



Tow



Refuse



Medium Semi Tractor



# Class 7-8 Vehicles and NGV Availability





# School/Transit Bus and NGV Availability



# Refuse Vehicles and NGV Availability



# Non-Road, High Horsepower Applications

## Rail



## Marine





# Non-Road, High Horsepower Applications





NGVs are road-tested, proven technologies that are operating worldwide



**160,000 +**  
on U.S. Roads



**23 million +**  
NGVs in Operation Worldwide

*Data Source: NGVGlobal, December 2016*

Several high-profile fleet operators use NGVs in daily operations



# Advantages of Natural Gas as a Transportation Fuel

Abundant Domestic Availability,  
Widespread Distribution Infrastructure,  
Low Cost and Price Stability



North America  
has an  
abundant  
domestic  
supply of  
conventional  
natural gas



**Natural Gas Producer  
in the World**



**North America  
has abundant  
sources of  
renewable  
natural gas that  
can be harnessed**



**FOOD WASTE**

**66.5 MILLION**  
TONS/YEAR



**WASTE WATER**

**17,000**  
FACILITIES



**AGRICULTURAL WASTE**

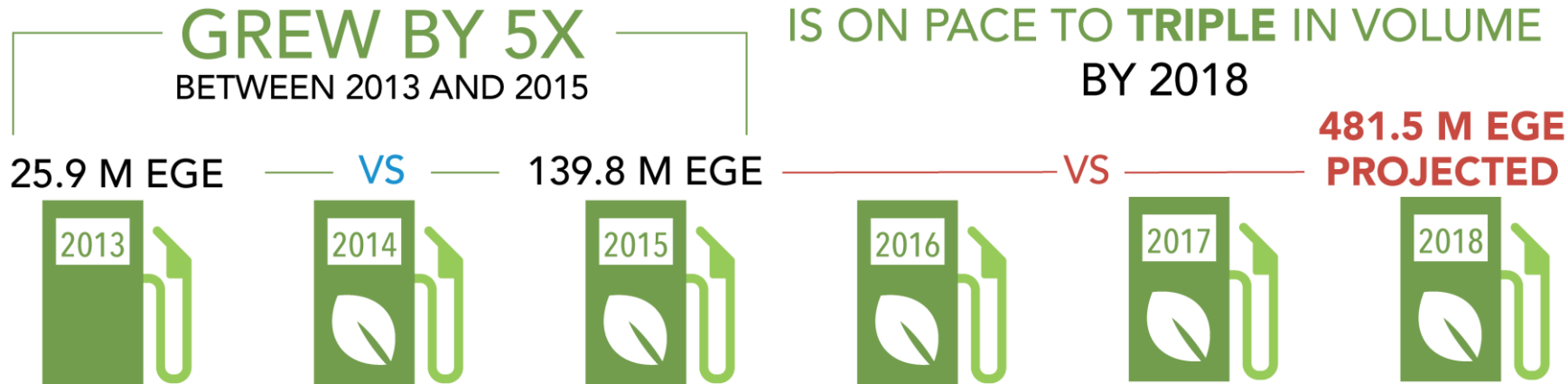
**8,000**  
LARGE FARMS AND DAIRIES



**LANDFILL GAS**

**1,750**  
LANDFILLS

# RNG PRODUCTION FOR TRANSPORTATION FUEL



Source: Coalition for Renewable Natural Gas, 2017

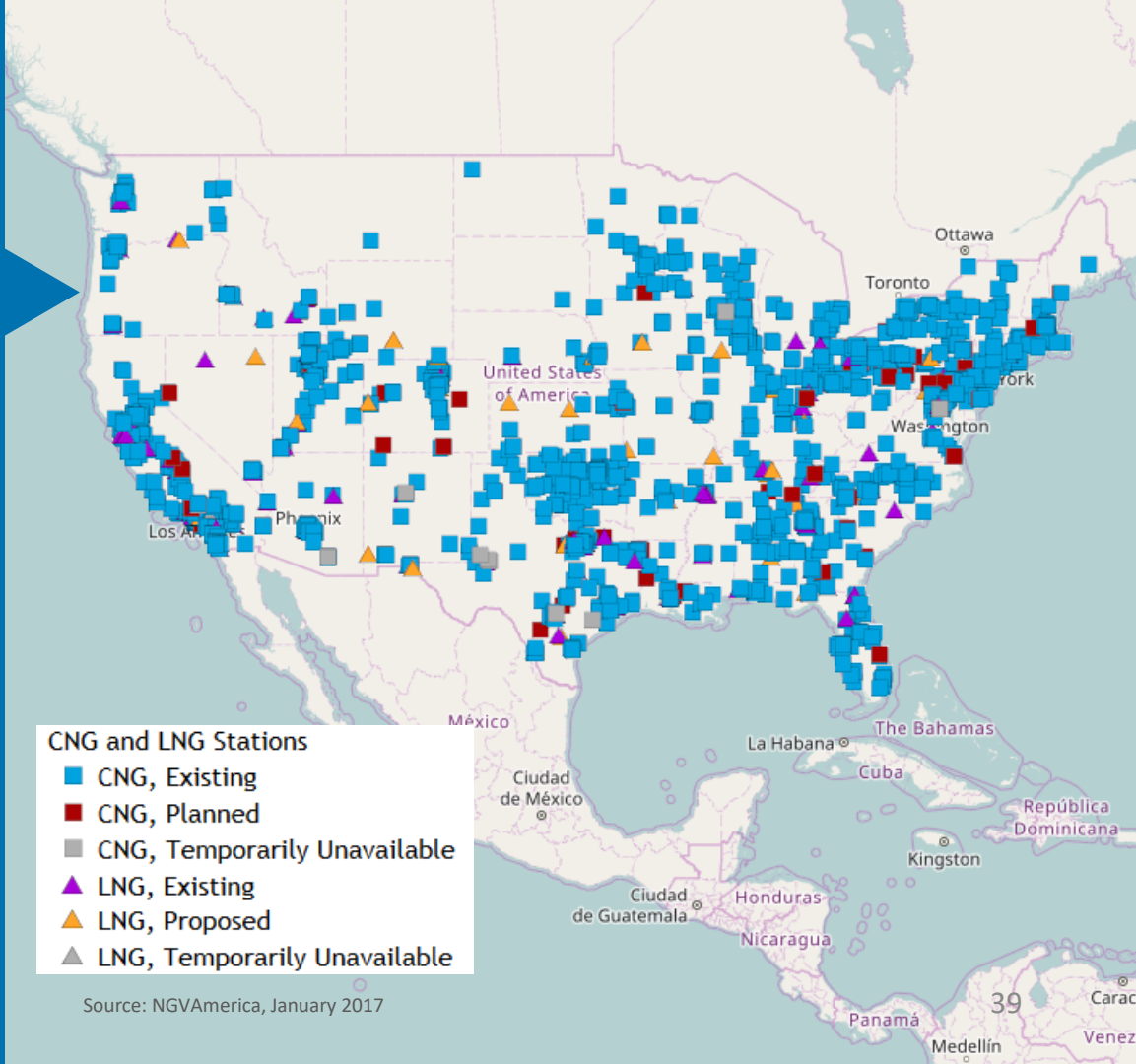
Renewable natural gas production is steadily increasing to meet growing demand throughout the U.S.

# Natural gas fuel station infrastructure is continually expanding



≈2,000 Natural Gas Stations

- More than doubled past 5 years
- 10-12+ new stations per month



Source: NGV America, January 2017



# Diverse network of natural gas station developers

- Natural gas retail fuel sellers
- LDCs
- C-Stores
- Truck Stops
- Grocery/Warehouse stores
- Leasing companies
- Gas exploration & production
- Midstream pipeline

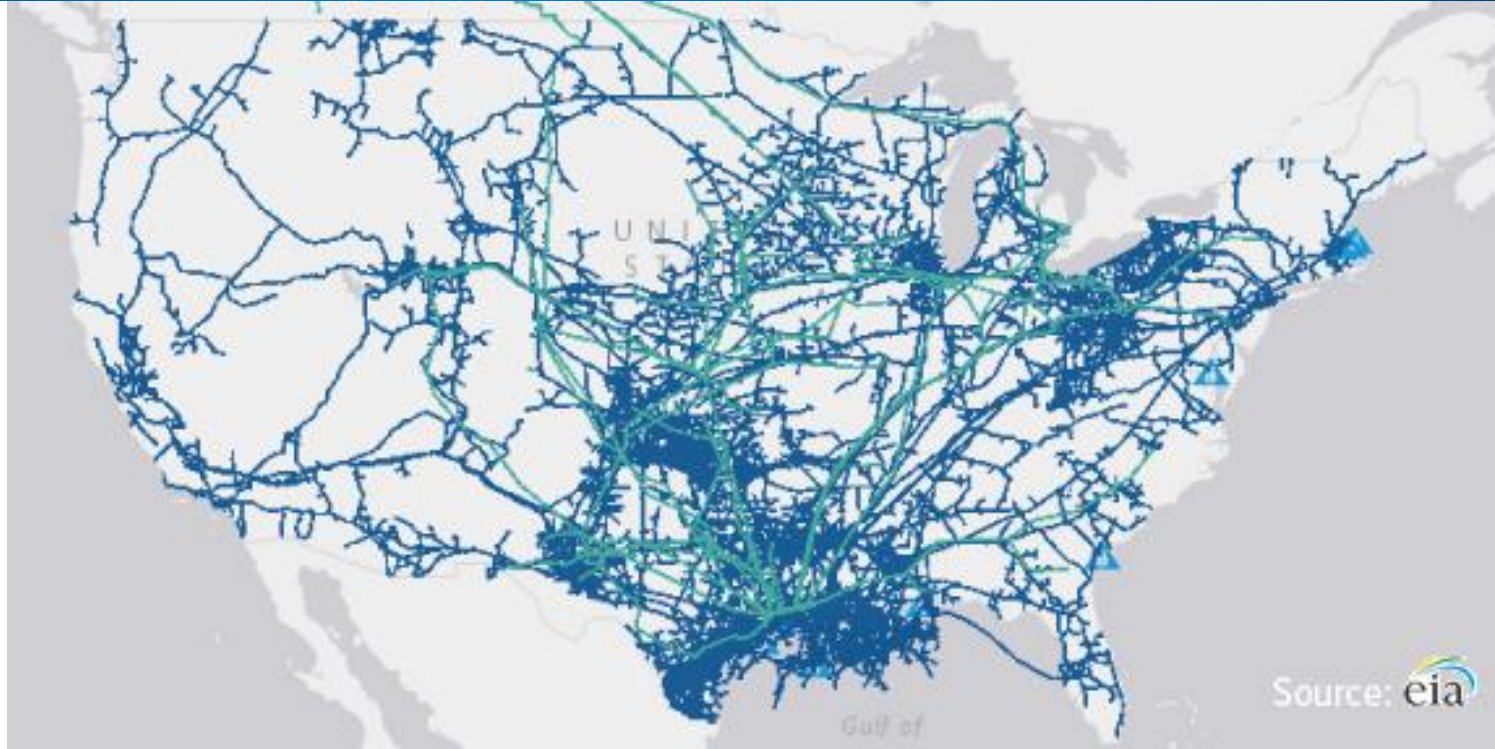




# The U.S. natural gas pipeline system is well poised to support a national network of CNG and LNG fueling stations

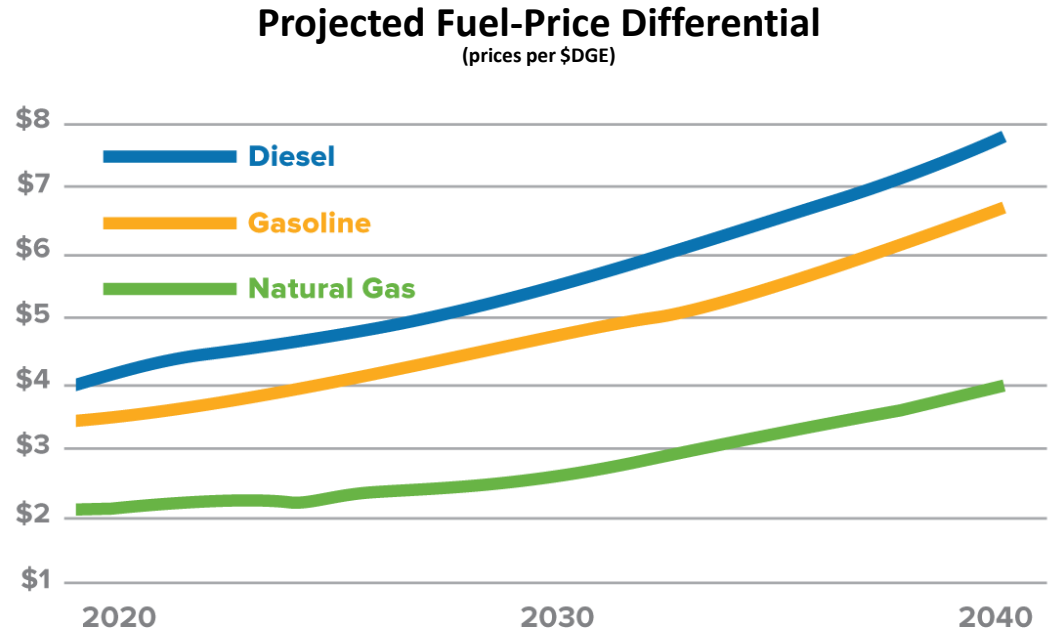
**2.5+  
million**

miles of U.S.  
pipeline  
infrastructure



Source:  eia

# Natural Gas Provides Long-Term Fuel Cost Savings



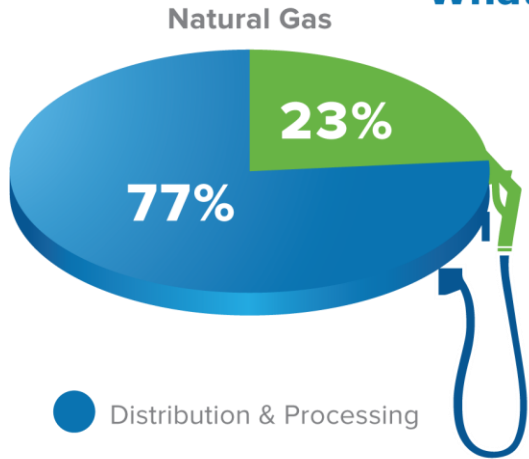
Source: U.S. Energy Information Administration

## Natural Gas vs. Oil:

- 3:1 price advantage over oil on a Btu basis
- Pump prices \$0.75 to \$1 lower than diesel

# Natural Gas Provides Fuel Price Stability

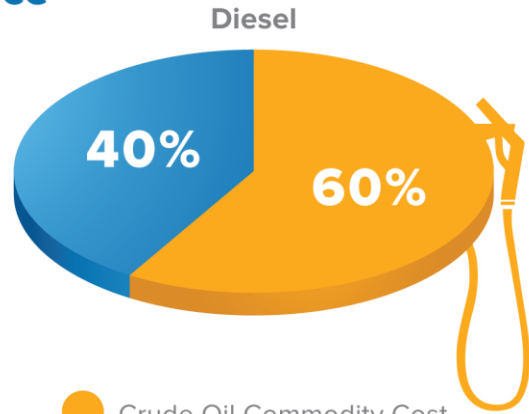
What makes up the total price  
at the pump?



Distribution & Processing



Natural Gas Commodity Cost



Crude Oil Commodity Cost

## Natural Gas:

- Decades of affordable domestic reserves
- Natural gas sourced from North America
- Commodity cost makes up 23% of sales price

## Diesel:

- History of volatile price swings
- Crude oil sourced fuel from high-conflict regions
- Commodity cost makes up 60% of sales price



Natural gas vehicles are up to 3x quieter than their diesel counterparts and significantly reduce noise pollution in the local community.

# Conclusion: NGVs are the Best Value for State VW Funds





# NGV America Recommendations

- ✓ Fund alternative fuel vehicle projects that maximize NOx reductions for the funds spent for both public and private fleets
- ✓ Provide greater funding for MD & HD vehicles powered or repowered by engines that deliver NOx reductions greater than current EPA standards
- ✓ Target funding for technologies that have demonstrated lower in-use emissions
- ✓ Prioritize funding for projects with commercially available products
- ✓ Stay flexible in plans and leverage private investment to stretch dollars and get more alternative vehicles on the road

# For more information:

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